OIPE JC11
MAY 26 2004
PATENT & TRADEMARK OFFICE

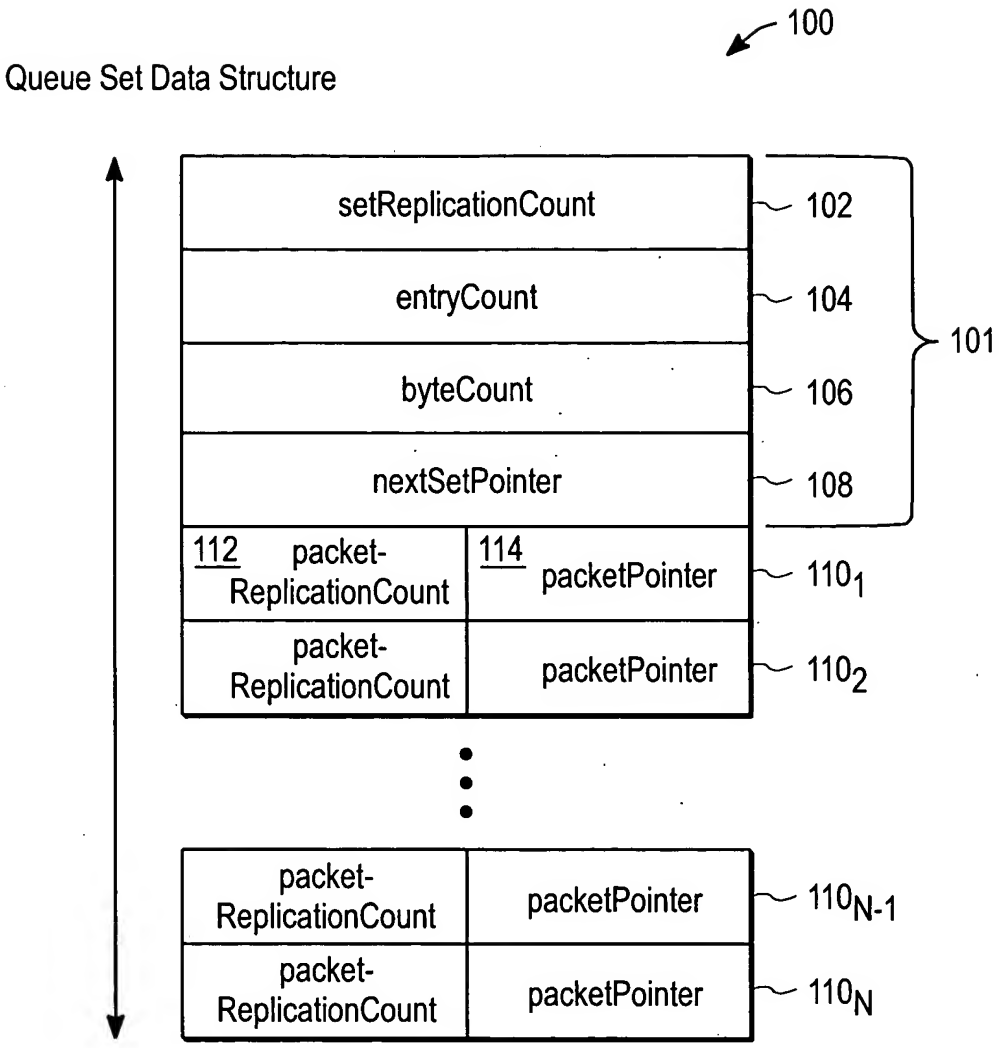

FIG. 1

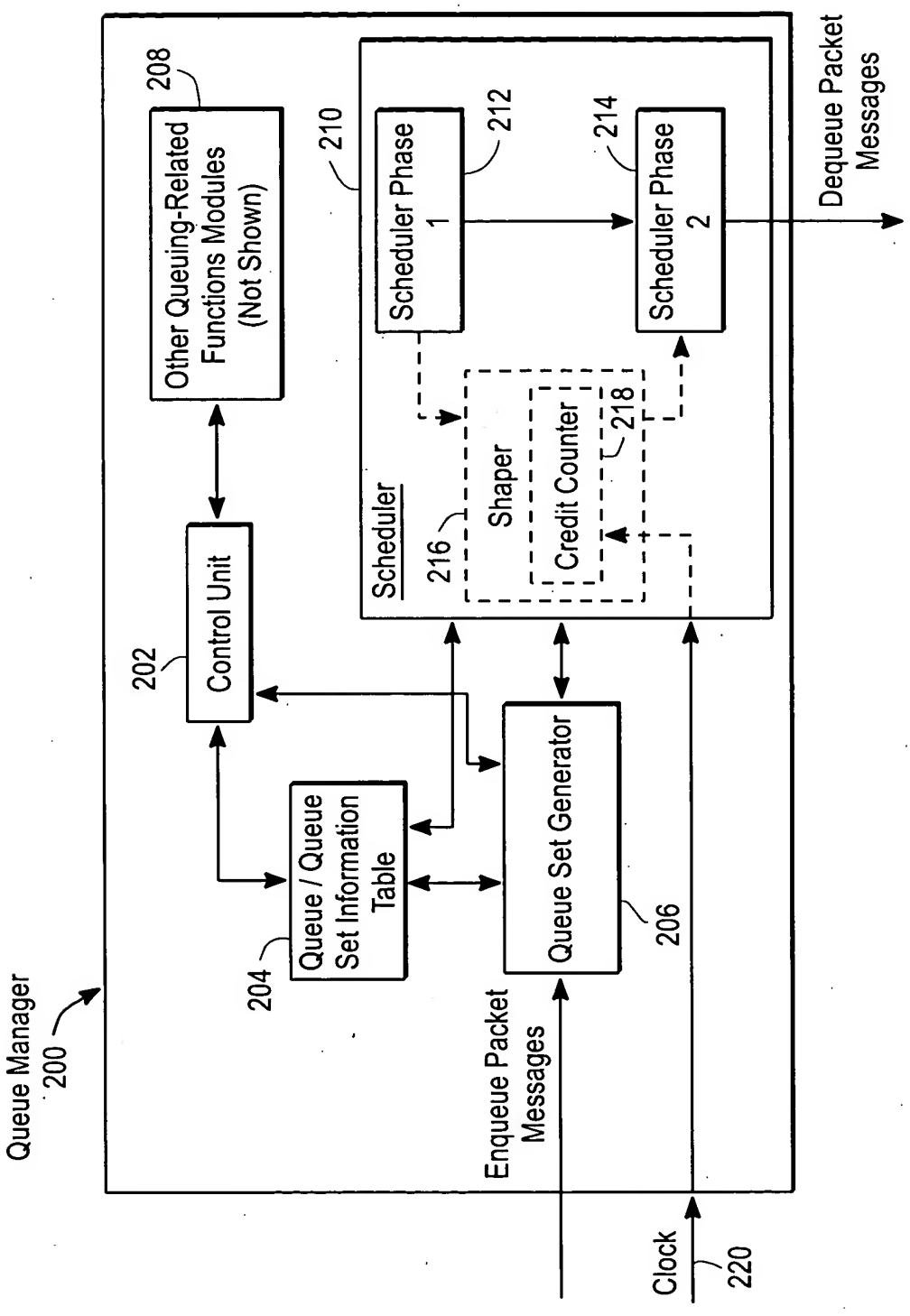
Queue Manager
200
Other Queuing-Related Functions Modules (Not Shown)
208
Control Unit
202
Queue / Queue Set Information Table
204
Queue Set Generator
206
Scheduler
210
Scheduler Phase 1
212
Scheduler Phase 2
214
Shaper
216
Credit Counter
218
Enqueue Packet Messages
Dequeue Packet Messages
Clock
220

FIG. 2

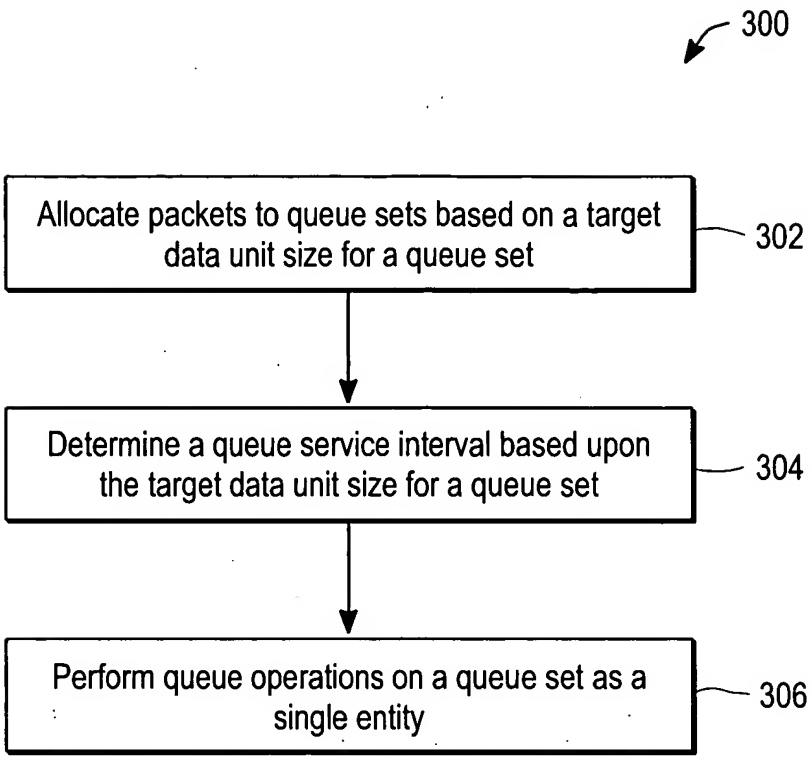
300
Allocate packets to queue sets based on a target data unit size for a queue set
302
Determine a queue service interval based upon the target data unit size for a queue set
304
Perform queue operations on a queue set as a single entity
306

FIG. 3

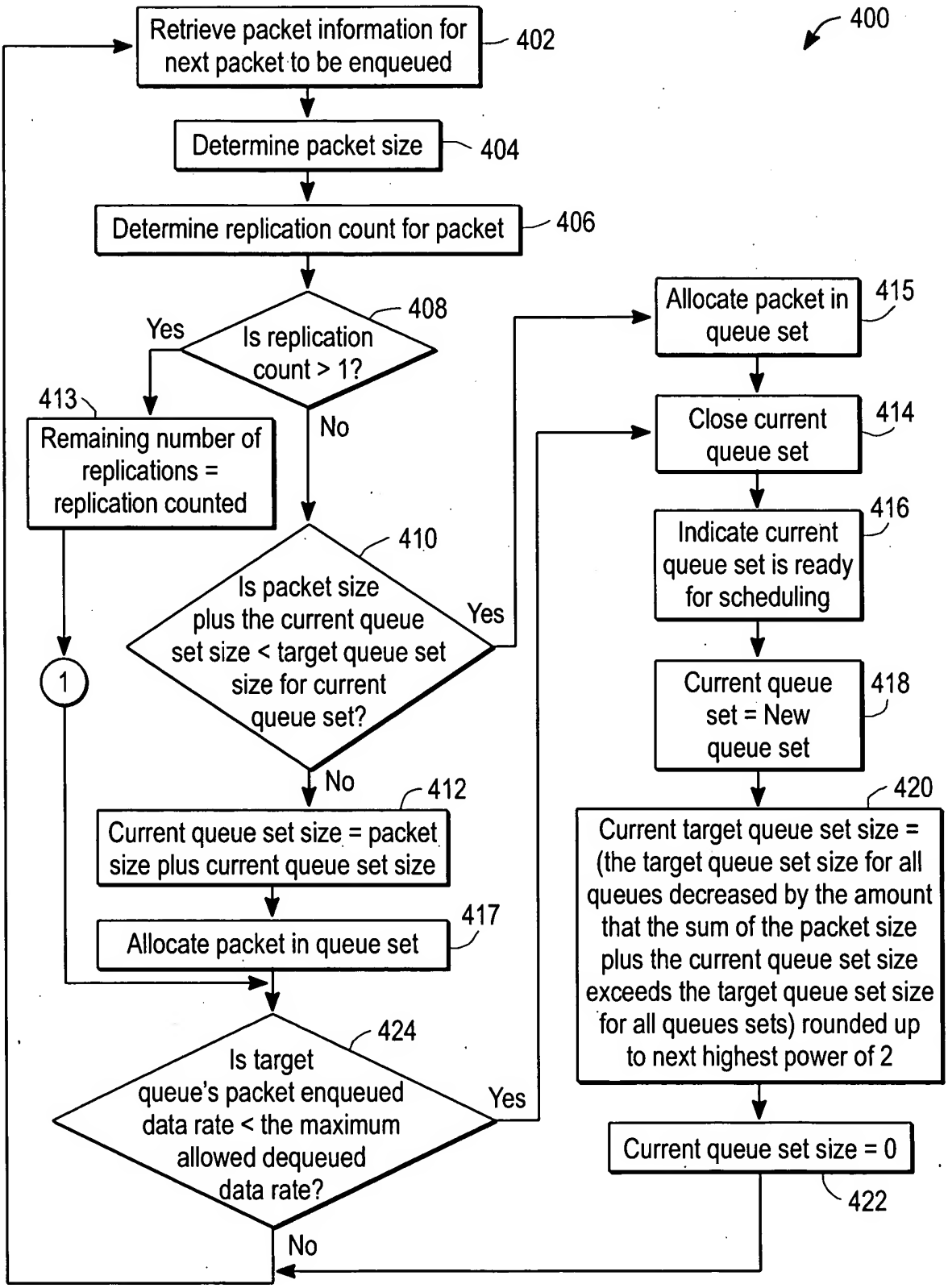
400
Retrieve packet information for next packet to be enqueued
402
Determine packet size
404
Determine replication count for packet
406
Is replication count > 1?
408
Yes
No
413
Remaining number of replications = replication counted
1
Is packet size plus the current queue set size < target queue set size for current queue set?
410
Yes
No
Allocate packet in queue set
415
Close current queue set
414
Indicate current queue set is ready for scheduling
416
Current queue set = New queue set
418
Current target queue set size = (the target queue set size for all queues decreased by the amount that the sum of the packet size plus the current queue set size exceeds the target queue set size for all queues sets) rounded up to next highest power of 2
420
Current queue set size = 0
422
Current queue set size = packet size plus current queue set size
412
Allocate packet in queue set
417
Is target queue's packet enqueued data rate < the maximum allowed dequeued data rate?
424
Yes
No

FIG. 4

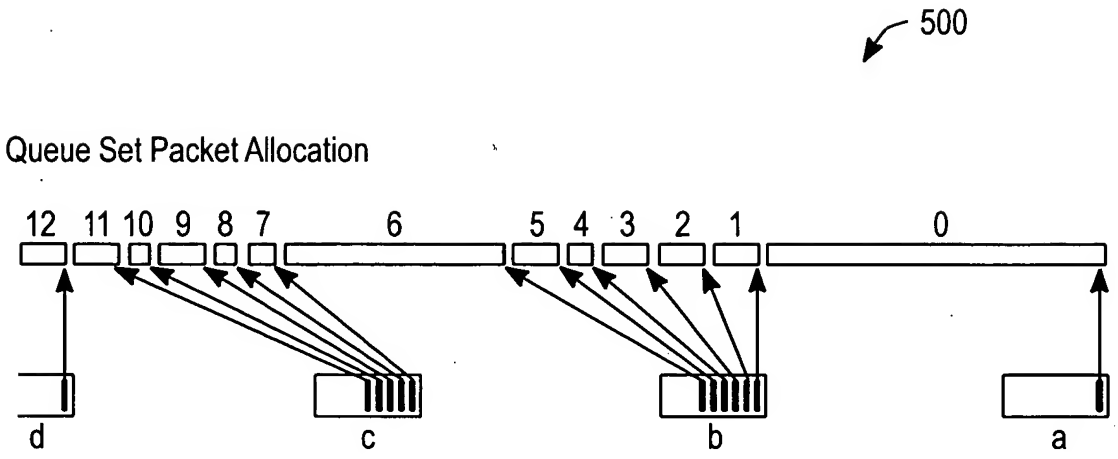

FIG. 5

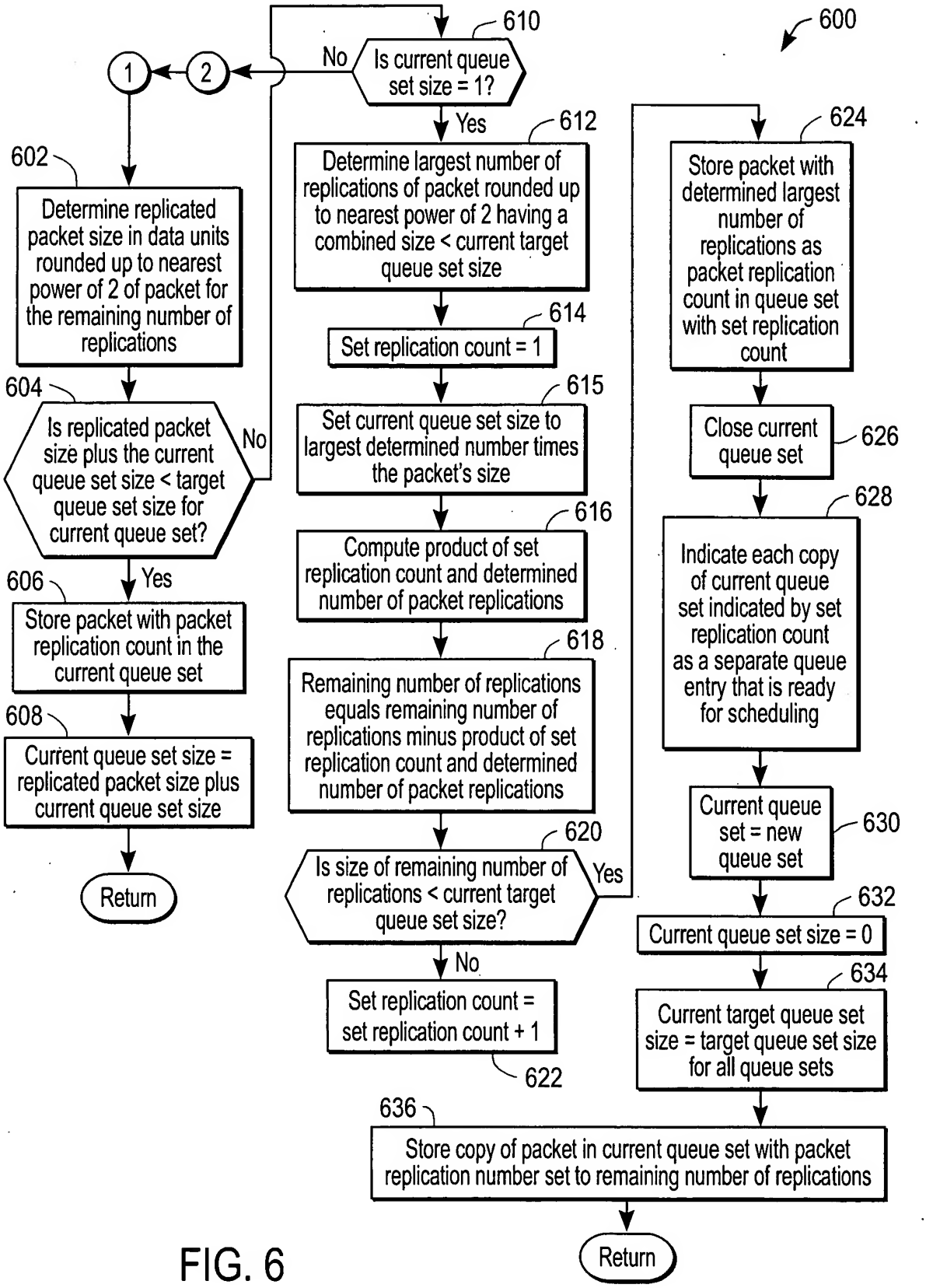
600
610
Is current queue set size = 1?
No
Yes
1
2
602
Determine replicated packet size in data units rounded up to nearest power of 2 of packet for the remaining number of replications
604
Is replicated packet size plus the current queue set size < target queue set size for current queue set?
No
Yes
606
Store packet with packet replication count in the current queue set
608
Current queue set size = replicated packet size plus current queue set size
Return
612
Determine largest number of replications of packet rounded up to nearest power of 2 having a combined size < current target queue set size
614
Set replication count = 1
615
Set current queue set size to largest determined number times the packet's size
616
Compute product of set replication count and determined number of packet replications
618
Remaining number of replications equals remaining number of replications minus product of set replication count and determined number of packet replications
620
Is size of remaining number of replications < current target queue set size?
Yes
No
Set replication count = set replication count + 1
622
624
Store packet with determined largest number of replications as packet replication count in queue set with set replication count
Close current queue set
626
628
Indicate each copy of current queue set indicated by set replication count as a separate queue entry that is ready for scheduling
Current queue set = new queue set
630
632
Current queue set size = 0
634
Current target queue set size = target queue set size for all queue sets
636
Store copy of packet in current queue set with packet replication number set to remaining number of replications
Return

FIG. 6

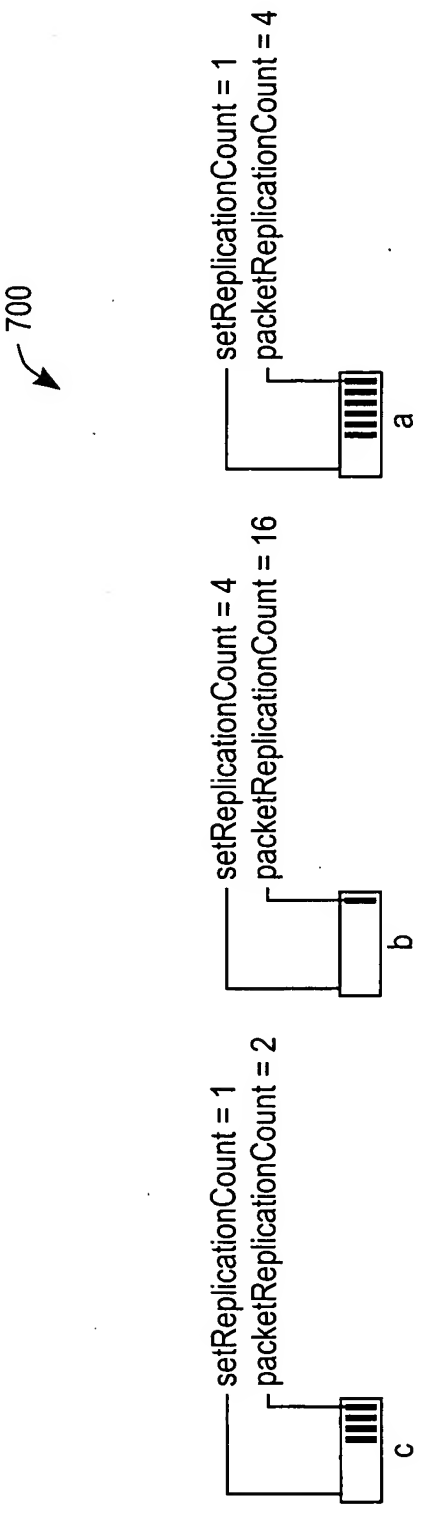
700
setReplicationCount = 1
packetReplicationCount = 4
a
setReplicationCount = 4
packetReplicationCount = 16
b
setReplicationCount = 1
packetReplicationCount = 2
c

FIG. 7

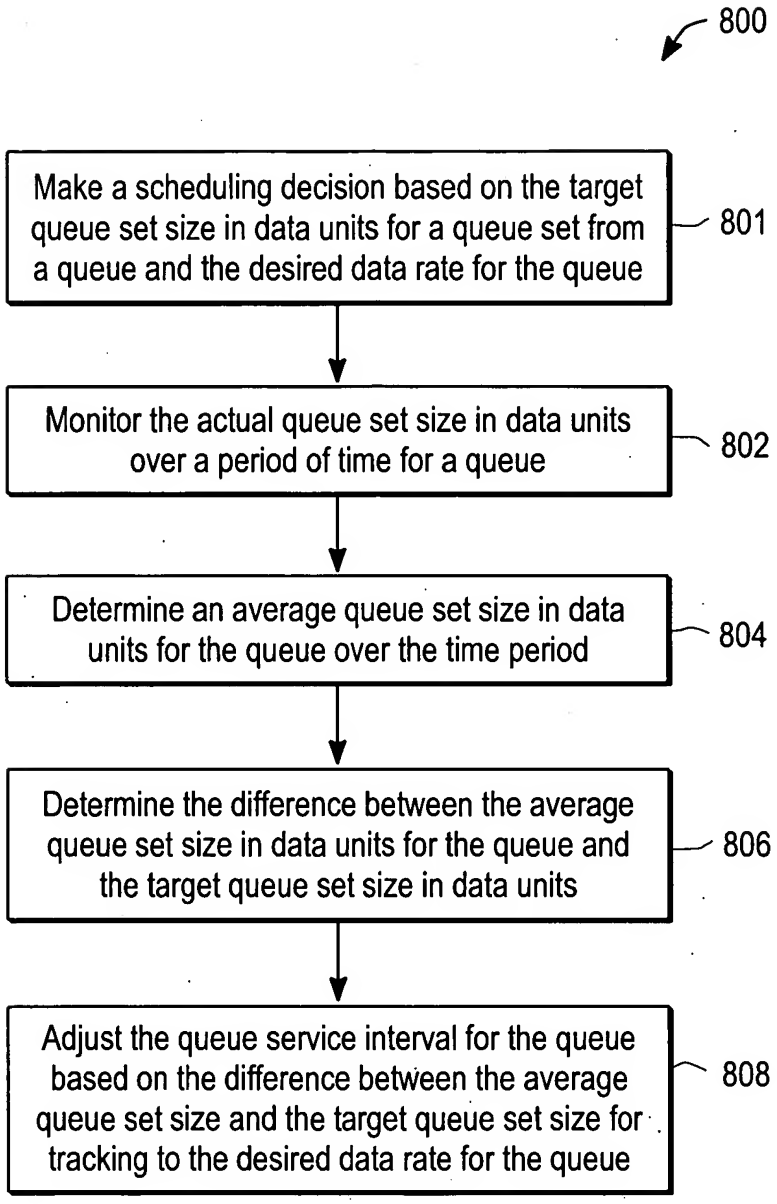
800
Make a scheduling decision based on the target queue set size in data units for a queue set from a queue and the desired data rate for the queue
801
Monitor the actual queue set size in data units over a period of time for a queue
802
Determine an average queue set size in data units for the queue over the time period
804
Determine the difference between the average queue set size in data units for the queue and the target queue set size in data units
806
Adjust the queue service interval for the queue based on the difference between the average queue set size and the target queue set size for tracking to the desired data rate for the queue
808

FIG. 8

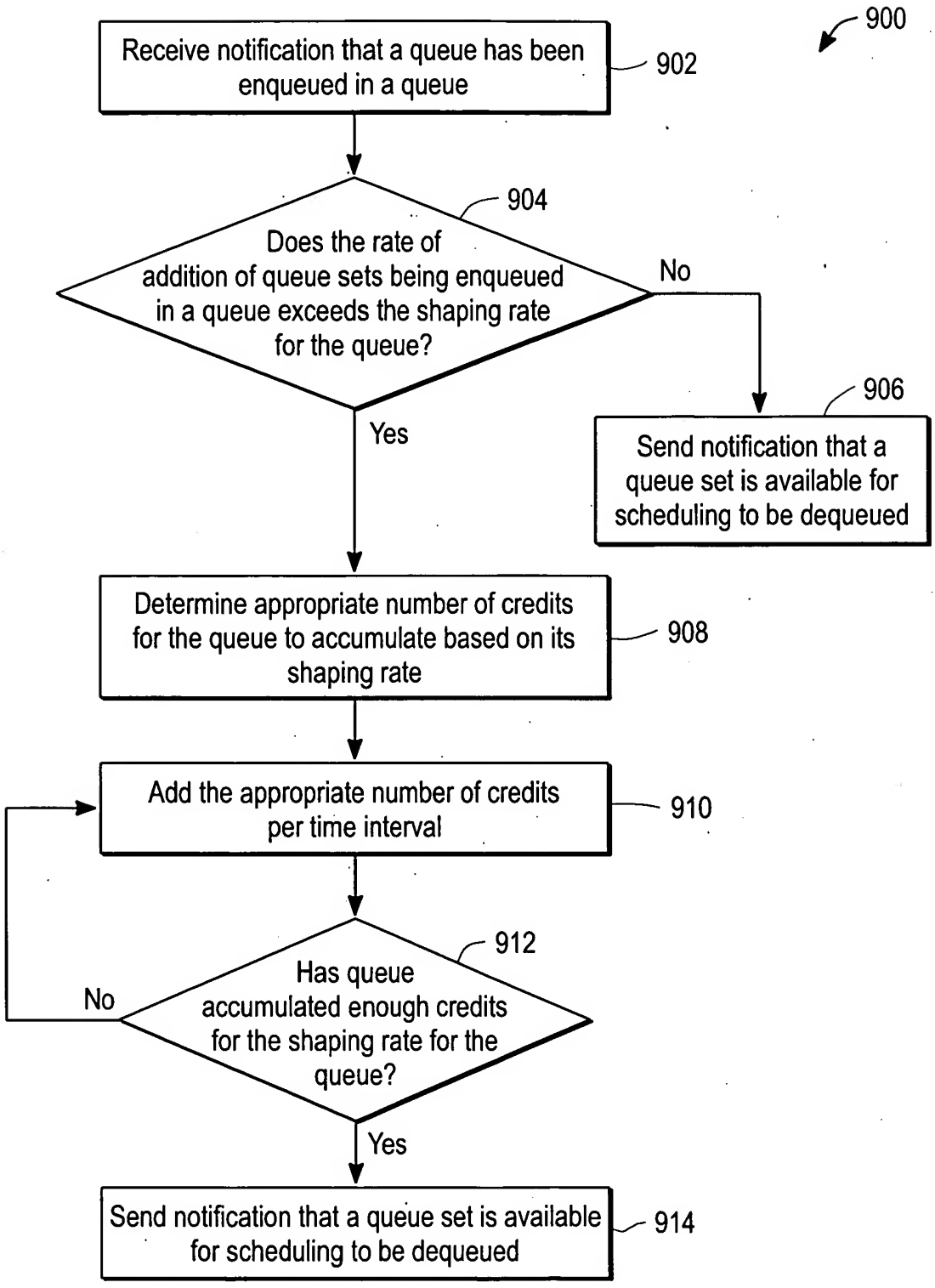
900
Receive notification that a queue has been enqueued in a queue
902
Does the rate of addition of queue sets being enqueued in a queue exceeds the shaping rate for the queue?
904
No
Yes
Send notification that a queue set is available for scheduling to be dequeued
906
Determine appropriate number of credits for the queue to accumulate based on its shaping rate
908
Add the appropriate number of credits per time interval
910
Has queue accumulated enough credits for the shaping rate for the queue?
912
No
Yes
Send notification that a queue set is available for scheduling to be dequeued
914

FIG. 9